contribute to high emissions and fuel use, regarding methods for reducing fuel use and emissions, and in order to more accurately estimate the contribution of heavy duty diesel vehicles to solving energy and environmental policy problems.

Background on Factors Influencing Emissions

Tailpipe emissions are a complex function of many influential variables, including vehicle characteristics, vehicle activity patterns, ambient conditions, fuel properties, and related issues. Examples of related issues include driver behavior, traffic flow, and roadway and route characteristics. These latter issues can influence the vehicle activity pattern. Overall, some of the key factors that influence emissions are found to be fuel properties, vehicle weight, speed and acceleration, and operating modes. In designing a field study for measurement of real-world in-use duty cycles and emissions, consideration was given to obtaining data for different vehicle weight, engine design, load, fuel, and operating mode. These factors are considered when developing the study design and interpreting the results of the data collected in the field.

Methods for Measuring Vehicle Emissions

Several commonly used methods for measuring vehicle emissions have been reviewed, including engine dynamometers, chassis dynamometers, tunnel studies, remote sensing, and on-board measurement. Most of the available data regarding heavy-duty vehicle emissions is typically from engine dynamometer measurements. These data are reported in units of g/bhp-hr, which are not directly relevant to in-use emissions estimation. Furthermore, many engine dynamometer test cycles are based upon steady-state modal tests that are not likely to be representative of real world emissions. There are some transient engine dynamometer tests that may have improved representativeness of real-world operating patterns, but it is not likely that any particular and arbitrary test cycle will be representative of operation of a particular type of vehicle at all times and in all areas of the country. Thus, although relatively less expensive than chassis dynamometer tests, engine dynamometer tests have serious shortcomings for purposes of estimating real world emissions.

Chassis dynamometer tests provide emissions data in units that are more amenable to the development of emission inventories. For example, for on-road vehicles, emissions can be reported in units of grams of pollutant emitted per mile of vehicle travel. This emission factor can be multiplied by estimates or measurements of vehicle miles traveled to arrive at an inventory. However, for vehicles that operate off-road, or that have operating modes that cannot easily be accommodated in the laboratory setting (e.g., dumping of the bed of a dump truck), it may not be possible to obtain data representative of all aspects of a duty cycle. Furthermore, these tests have a non-negligible cost per vehicle and the number of heavy duty dynamometer facilities is limited.

Tunnel studies are limited in their ability to discriminate among specific vehicle types, although it is possible to distinguish between gasoline and diesel vehicles using statistical methods. However, tunnel studies are based upon measurements for a specific link of roadway and thus are not representative of an entire duty cycle. For purposes of this project, there are no tunnels through which the study fleet travels. Thus, this measurement method is not applicable here.

Remote sensing can be used to measure emissions from any vehicle that passes through the infrared and, if available, UV beams that are used to measure pollutant concentrations. For purposes of measuring heavy duty vehicles, remote sensing deployment may need to be adjusted